

Technical training.
Product information.

F48 Powertrain



BMW Service

Edited for the U.S. market by:
BMW Group University
Technical Training

ST1508

9/1/2015

General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:



Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

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The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **June 2015**
BV-72/Technical Training

F48 Powertrain

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1. Drive Variants

The F48 is available with xDrive. The following graphic shows the layout of that version.



F48 Drive

In the F48 a completely new drive unit is used, which fits perfectly with the spatial functional concept of the BMW X1 thanks to its model-specific design.

The new BMW X1 xDrive28i is one of the first vehicles of BMW which will be driven by the brand new 4-cylinder engine. It is a part of the newly developed modular engine family. It is a lightweight, powerful and economical engine, which is equipped with BMW TwinPower Turbo technology.

Special features

- New 4-cylinder engines
- Engine with transverse mounting
- xDrive
- All engines satisfy the exhaust emission standards SULEV

F48 Powertrain

1. Drive Variants

The following list shows the advantages of the different drive concepts (for vehicles with a front engine):

Front-wheel drive	Rear-wheel drive
<ul style="list-style-type: none"> • The drive unit is comparatively compact and is integrated between the axle mounting, steering and footwell. • Large and variable spatial offering thanks to reduction or deletion of the transmission tunnel and rear axle differential. • Weight and cost reductions, due to deletion of propeller shaft and rear axle differential, as well as integration of the differential in the transmission. • Good traction on smooth roadway, independent of the load status of the vehicle, due to higher axle load at the driven axle. • Reasonable behavior in the event of a head-on collision (engine and transmission intrude the passenger compartment less). 	<ul style="list-style-type: none"> • Small turning circle possible, as no rear view of the drive required with the steered front axle. • No annoying drive influences in the steering. • Good power transmission to the roadway during acceleration, as the driven axle is loaded (primarily when driving off on inclines). • Balanced axle-load distribution possible. • Excellent dynamic cornering behavior.

1.1. Model

The following model is offered for the market introduction of the F48:

Model		BMW 228i
Engine		B46A2000
Cylinders		4
Displacement	[cm ³]	1998
Power	[kW (HP)]	170 (231)
Torque	[Nm]	350
Automatic transmission		GA8F22AW
Manual gearbox		–

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1. Drive Variants

1.2. Engine designation

In the technical documentation, the engine designation is used to ensure unambiguous identification of the engine. In the following table the engine designations used in the F48 are explained.

Position	Meaning	Index	Explanation
1	Engine developer	B	BMW Group
2	Engine type	4	4-cylinder in-line engine
3	Change to the basic engine concept	8	Turbo-Valvetronic direct injection (TVDI)
4	Working method or fuel and installation position	A	Petrol engine, transversal installation
5 + 6	Displacement in 1/10 liter	20	2.0 liters displacement
7	Performance class	U M O	Lower Middle Upper
8	Revision relevant to approval	0 1 – 9	New development Redesign

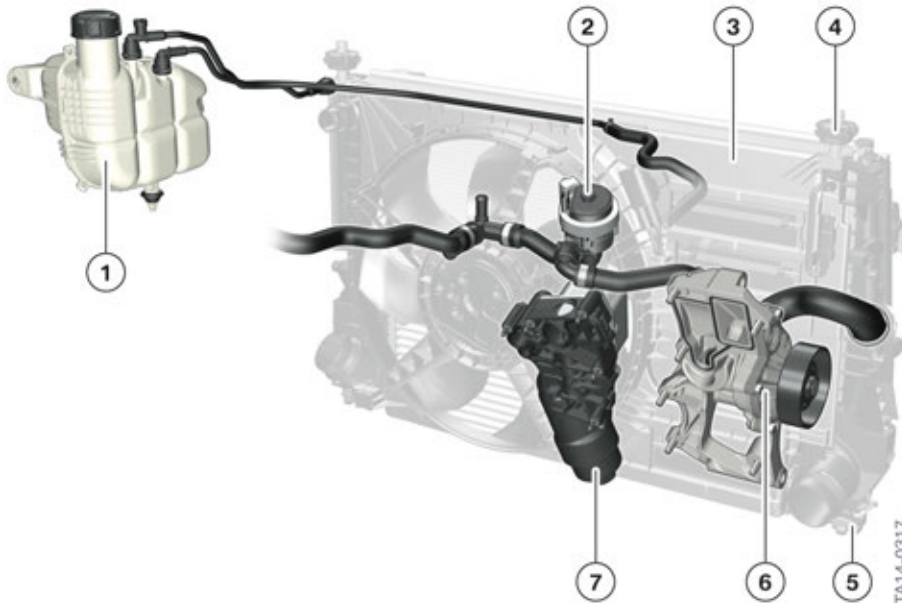
1.2.1. Engine identification

The 7-digit engine identification is on the crankcase. The first 6 digits of the engine identification are deduced from the engine type. Only the seventh digit is different. With the engine identification the test number of the type approval certification is located at the 7th position.

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2. Cooling System

2.1. Cooling module



F48 cooling system for B48 engine

Index	Explanation
1	Expansion tank
2	Electric coolant pump
3	Cooling module
4	Cooling module bearing, top
5	Cooling module bearing, bottom
6	Coolant pump
7	Engine oil-to-coolant heat exchanger

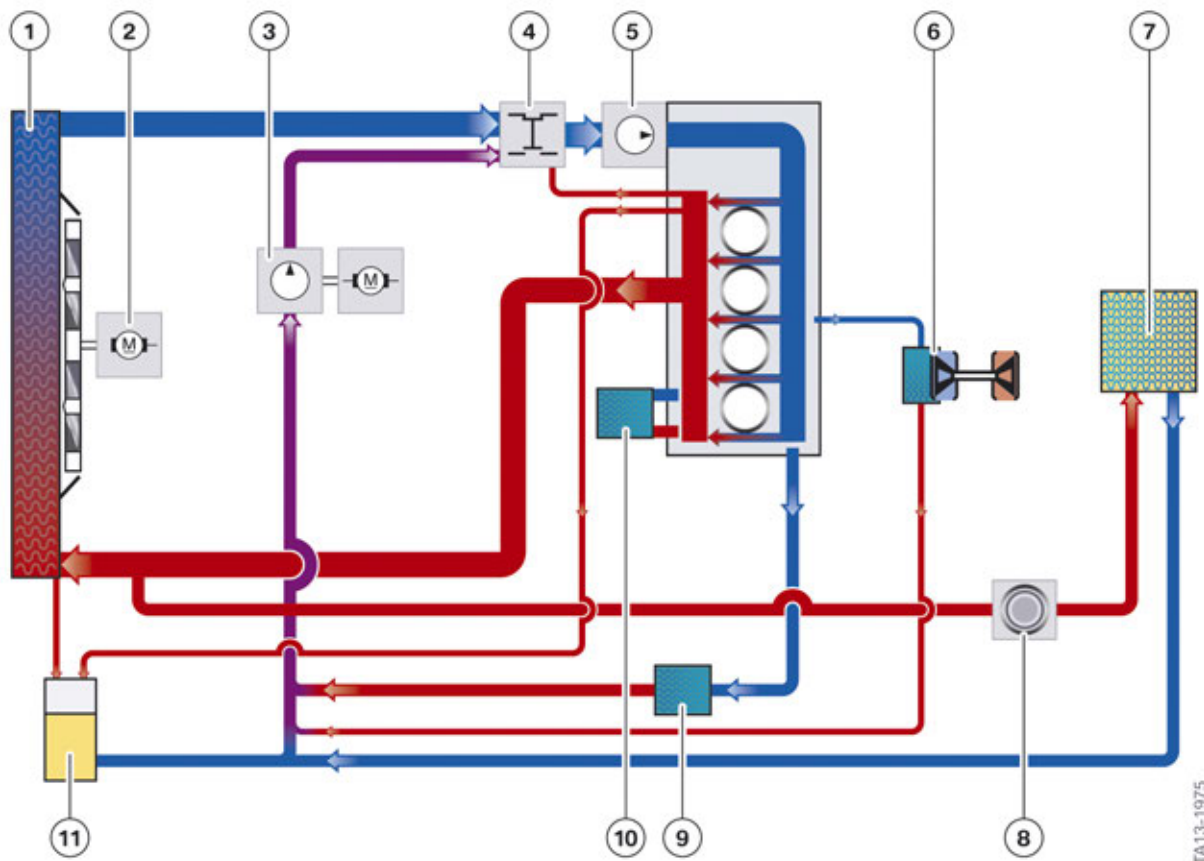
A frameless cooling module is installed in the F48. This is made possible by a concept with different separation points between radiator and charge air cooler, using, joint interfaces for body and coolant hoses.

In vehicles with an automatic transmission, a transmission oil-coolant-heat exchanger is also flange-mounted at the transmission. This is supplied with coolant via the crankcase and adapted coolant hoses.

In the following diagram you see the connection of the cooling module at the cooling circuit using the example of the B46 engine.

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2. Cooling System



F48 cooling circuit, B46 engine

Index	Explanation
1	Radiator
2	Electric fan
3	Electric coolant pump
4	Thermostat
5	Coolant pump
6	Exhaust turbocharger
7	Heat exchanger
8	Coolant shutoff valve
9	Transmission oil-to-coolant heat exchanger
10	Engine oil-to-coolant heat exchanger
11	Expansion tank

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3. Automatic Transmission



TA15-1114

F48 automatic transmission

In the F48 a new 8-speed automatic gearbox GA8F22AW are used:

Designation	Gears	Transferable torque	Use in engine
GA8F22AW	8-speed	350 Nm	B46A2000

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3. Automatic Transmission

The excellent efficiency was able to be achieved by the following measures:

- Small oil pump
- Lower transmission oil main pressure
- Optimal lubricating oil quantity
- Transmission oil with low viscosity
- Large steering axis inclination
- Very accurate control of the multidisc converter lockup clutch at low loads by three-line activation
- Designed for automatic engine start-stop function (there is also an electric oil pump in the hydraulic block in order to maintain the minimum oil pressure)
- Designed for idle speed coasting

Good ride and shifting comfort was able to be realized with the following measures:

- Newly developed mechanical torsional vibration damper
- Efficient hydraulics with new valves
- Efficient clutch and brake control
- Excellent direct shifting capability (multiple downshifts, explained in the following)

In the Sport program and Manual mode the shift point and shift speed have a more sporty dimension.



F48 EGS, 8-speed automatic transmission

The electronic transmission control is located in the F48 on the transmission housing. The selector lever position switch is designed as a hall effect sensor and integrated in the EGS. The outer wiring between EGS, selector lever position switch and transmission was discontinued, whereby the susceptibility to faults was also reduced.

F48 Powertrain

3. Automatic Transmission

3.1. Designation

The transmission designation in the technical documentation allows it to be uniquely identified. In frequent cases, however, only a short designation is used. This short form is used so the transmission can be assigned to a transmission family. The GA8HP transmission family, consisting of several transmissions such as the GA8HP45Z, the GA8HP70Z and the GA8HP90Z, is often mentioned.

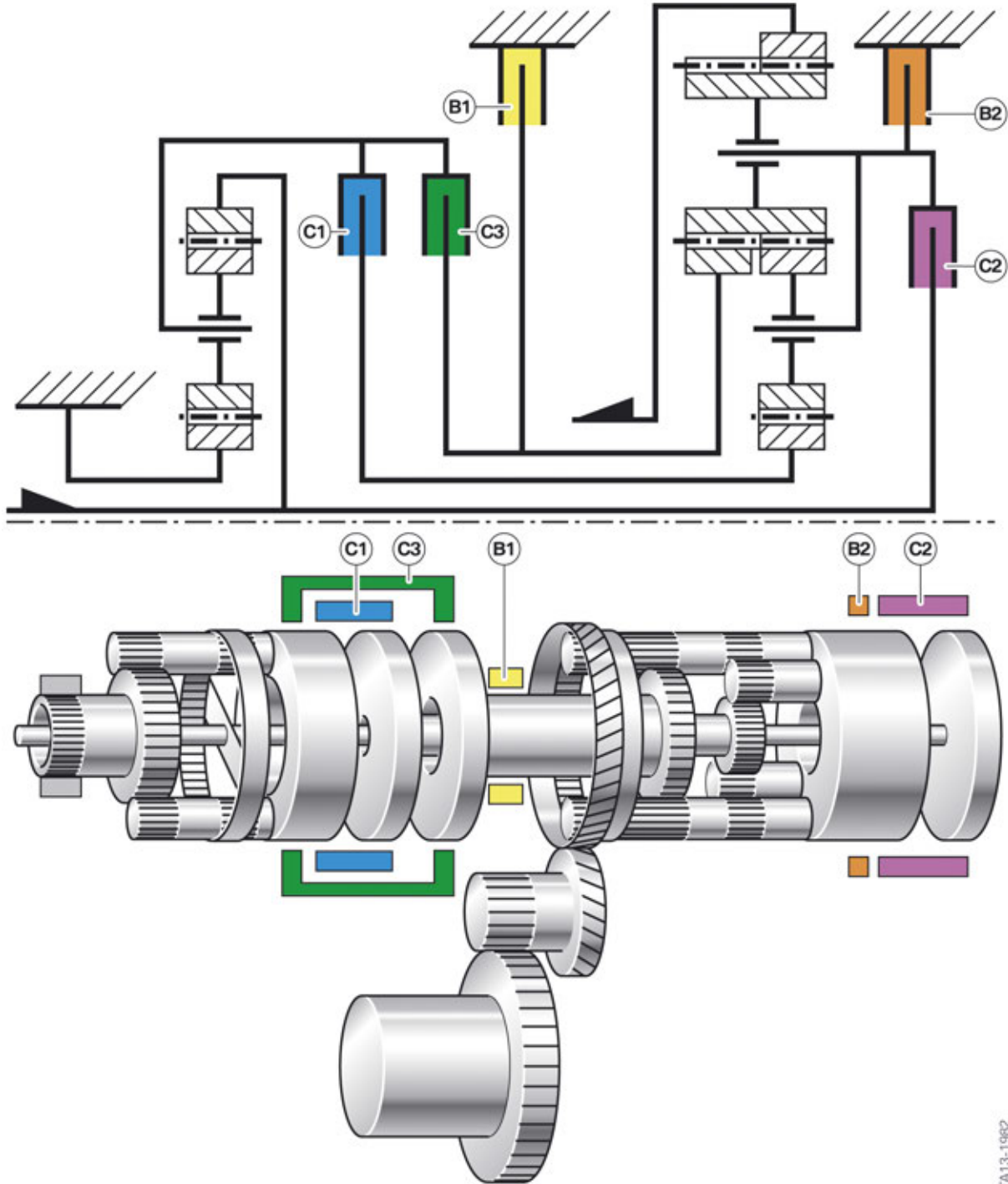
Position	Meaning	Index	Explanation
1	Designation	G	Transmission
2	Type of transmission	A	Automatic transmission
3	Number of gears	8	Eight forward gears
4 – 7*	Individual designations*	HP	Hydraulic planetary gear
		L	Designation of General Motors Powertrain
		R	Designation of General Motors Powertrain
		19	300 Nm gas engine
		F21A	Designation of AISIN Warner
		26	600 Nm
		32	720 Nm
		45	450 Nm
		(Zahnradfabri	350 Nm
		Friedrichshaf	700 Nm
		45	900 Nm
		(General Motors Powertrain)	390 Nm, 4th gear 410 Nm,
		70	
		90	
		390	
8	Manufacturer	A	AISIN
		G	Getrag
		J	Jatco
		K	GKN
		R	General Motors Powertrain
		Z	Zahnradfabrik Friedrichshafen
		H	In-house part

* Numbers 4 – 7 serve for individual designation. A transmission variant, size, transferable torque and technical update can be represented here.

F48 Powertrain

3. Automatic Transmission

3.2. Function diagram



Function diagram using the example of a 6-speed automatic transmission

TA13-1962

F48 Powertrain

3. Automatic Transmission

Index	Explanation
B1	Brake band B1 (blocks the front sun gear of the rear planetary gear set)
B2	Brake clutch B2 (blocks the planet carrier of the rear planetary gear set)
C1	Drive clutch C1 (connects the planet carrier of the front planetary gear set to the rear sun gear of the rear planetary gear set)
C2	Drive clutch C2 (connects the intermediate shaft to the planet carrier of the rear planetary gear set)
C3	Drive clutch C3 (connects the planet carrier of the front planetary gear set to the front sun gear of the rear planetary gear set)

3.3. Ratios

	GA8F22AW
Ratio, 1st gear	5.25
Ratio, 2nd gear	3.029
Ratio, 3rd gear	1.95
Ratio, 4th gear	1.457
Ratio, 5th gear	1.221
Ratio, 6th gear	1
Ratio, 7th gear	0.809
Ratio, 8th gear	0.673
Ratio, reverse gear	4.015

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3. Automatic Transmission

3.4. Direct shifting

With the new automatic transmission of the F48, in most cases direct shifting to the desired gear is possible. This also applies if gears are skipped.

A direct gear change is always possible if the status has to change for one of the switched clutches or brakes. Otherwise, a two-stage gear change is performed. However, in general the customer does not notice this due to the optimized transmission control unit.

The following table shows the switched brakes and clutches for each gear using the example of the GA6F21AW.

Gear	Brake B2	Brake B1	Clutch C2	Clutch C1	Clutch C3
N	X				
1	X			X	
2		X		X	
3				X	X
4			X	X	
5			X		X
6		X	X		
Rw	X				X

Examples:

- Direct shift is possible from 4th to 2nd gear, as the clutch C1 does not have to be shifted.
- Direct shift is not possible from 5th to 2nd gear as both the brake B1 and the clutch C1 have to be switched.

3.5. Coasting in idle

For the F48 the "Coasting in idle position" function is available. Under certain prerequisites the engine is automatically disconnected from the transmission in gear selector switch position D. The engine runs here at idle speed.

Further information on "Coasting" is available in the product information bulletin "F01/F02 LCI Displays and Operation".

3.6. Launch Control

For vehicles with Sports automatic transmission (SA 2TB), launch control enables optimal acceleration when driving off. Forced upshifts are also performed without a reduction of the engine torque. This enables additional acceleration during the gearshifts.

In order to avoid premature component wear, the drive-off with launch control is only available 100 times over the service life of the Sports automatic transmission and cannot be reset by Service.

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3. Automatic Transmission

3.6.1. Activation of launch control

Step	Responsibility
1	Press the DSC button and select SPORT using the driving experience switch. – In the instrument cluster TRACTION is displayed in combination with SPORT. The indicator light DSC OFF illuminates.
2	Engage drive position S.
3	Firmly press the brake using the left foot.
4	Press the accelerator pedal beyond the resistance at the kick-down pressure point and hold. – Flag symbol appears in the instrument cluster and the engine speed for pulling away is adjusted.
5	Release the brake within 3 seconds and hold the accelerator pedal. – Vehicle accelerates optimally.

3.7. ConnectedShift

ConnectedShift uses navigation data for a forward-thinking shift strategy of the automatic transmission. If, for example, a sharp bend is detected, the automatic transmission shifts down early and the gear is retained in the bend.

The route guidance of the navigation system does not need to be activated for the function. However, the identification of a turn-off request, for example by the active route guidance or operating the turn indicator, helps to control the system more accurately. Up-to-date navigation map data also influences the control accuracy.

3.7.1. Characteristics and availability

In SPORT and COMFORT modes, the characteristics of ConnectedShift are adapted to the respective driving program, in ECO PRO mode ConnectedShift is not available. ConnectedShift is also not available during control operation of cruise control.

ConnectedShift is used in the F48, depending on the equipment, specifically in vehicles with gas engine, automatic transmission and navigation system.

A prerequisite is that the map data and the required additional information for the country are available. This is dependent on the navigation map provider and is not available worldwide for all countries.

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3. Automatic Transmission

3.8. Notes for Service

3.8.1. Special tools

Two new diagnostic cables were designed for the automatic transmission as special tools:

- Adapter cable 15-pin: 83 30 2 352 734
- Adapter cable 33-pin: 83 30 2 352 718

3.8.2. Manually unlocking the drive position lock



F48 Manually unlocking the drive position lock

If the gear selector switch is blocked in selector lever position P despite the ignition being switched on, brake being applied and the Unlock button being pressed, the drive position lock can be manually unlocked. There is a release lever under the sleeve for the gear selector switch, which can be operated using the screwdriver from the toolkit, for example.

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3. Automatic Transmission

3.8.3. Available replacement parts

The following components of the automatic transmission are created as replacement parts in addition to various retaining and sealing elements:

- Cable holder (at transmission housing)
- Gearshift lever (at gearshift shaft)
- Electronic transmission control (EGS)
- Oil filler plug
- Electrical wiring set
- Gearbox input-speed sensor
- Hydraulic shift unit
- Cover (hydraulic shift unit)
- Transmission oil cooler
- Oil drain plug (with overflow)
- Torque converter
- Radial shaft seals for transmission input shaft, as well as left and right axle shaft

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4. xDrive

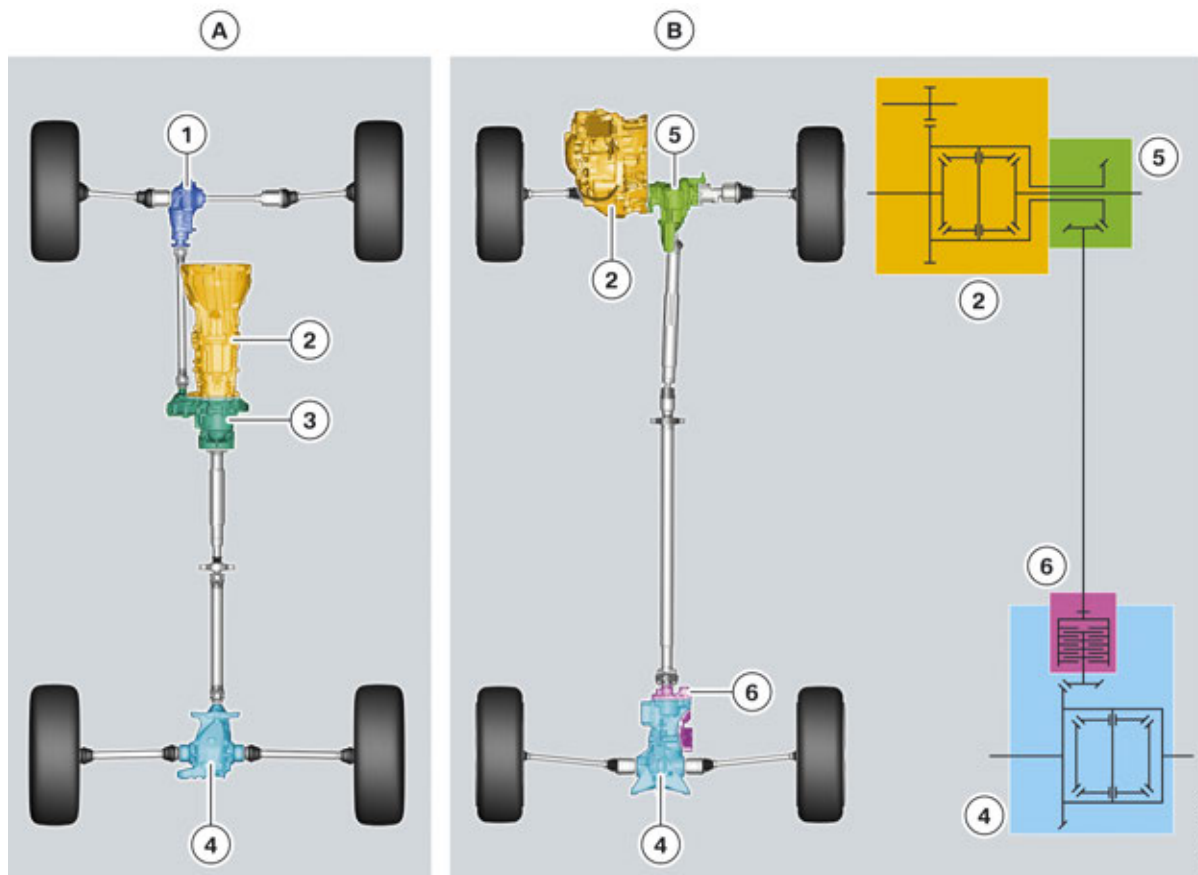
4.1. Introduction

The all-wheel drive system in the F48 was redeveloped and for the first time at BMW. Although this all-wheel drive system is also called xDrive, it is considerably different from the versions previously installed, which were based on a rear-wheel drive.

The differences of the xDrive versions are listed in the following section.

4.1.1. Comparison of all-wheel drive systems

The following graphic shows the all-wheel drive system of the F48 compared to the F25.



Comparison of the all-wheel drive system: F25 – F48

Index	Explanation
A	Four-wheel drive F25
B	Four-wheel drive F48
1	Front axle differential
2	Automatic transmission

F48 Powertrain

4. xDrive

Index	Explanation
3	Transfer box
4	Rear axle differential
5	Angular gearbox
6	Longitudinal torque distribution (integrated in the rear axle differential)

The following table shows the key differences of the all-wheel drive systems in the F25 and in the F48.

	F25	F48
Longitudinal torque distribution requirement (setpoint torque)	DSC	DSC
Control of the longitudinal torque distribution	VTG control unit	Longitudinal torque distribution control unit
Longitudinal torque distribution	Multidisc clutch in the transfer box	Multidisc clutch of the longitudinal torque distribution
Drive torque when multidisc clutch open	100 % at rear axle	100 % at front axle
Activation of multidisc clutch	Via electric motor and ball ramp	Via EHPS and hydraulic operating pressure

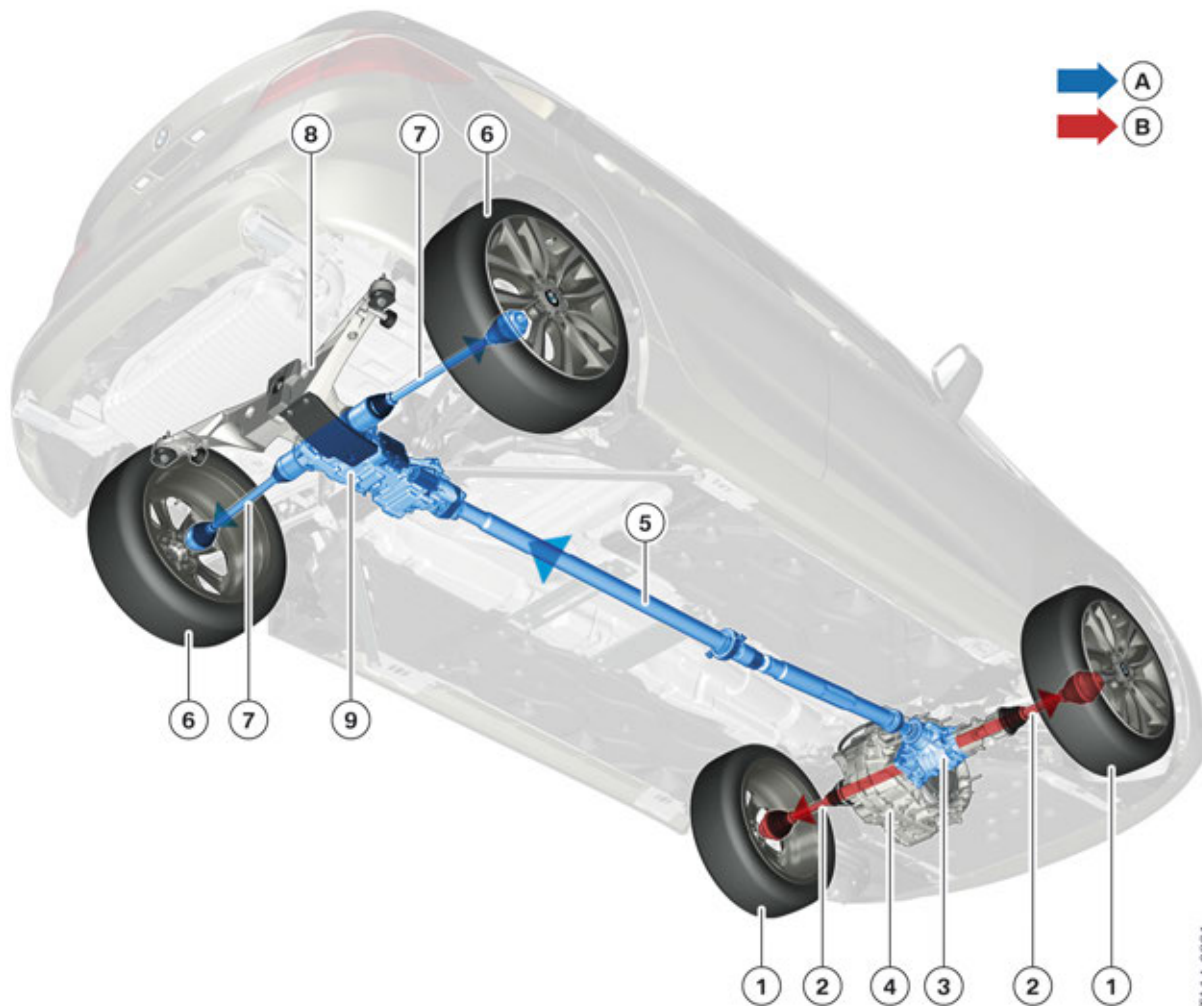
The new all-wheel drive system with longitudinal torque distribution clutch has the following advantages in comparison to the all-wheel drive system with transfer box:

- Low space requirement
- Low weight
- Low splashing losses in the multidisc clutch (thanks to "Efficient mode")
- CO₂ reduction

F48 Powertrain

4. xDrive

4.2. System components



F48 overview of four-wheel drive

Index	Explanation
A	Driving power to the rear wheels
B	Driving power to the front wheels
1	Front wheel
2	Output shaft, front
3	Angular gearbox
4	Automatic transmission
5	Propeller shaft

TA14-0321

F48 Powertrain

4. xDrive

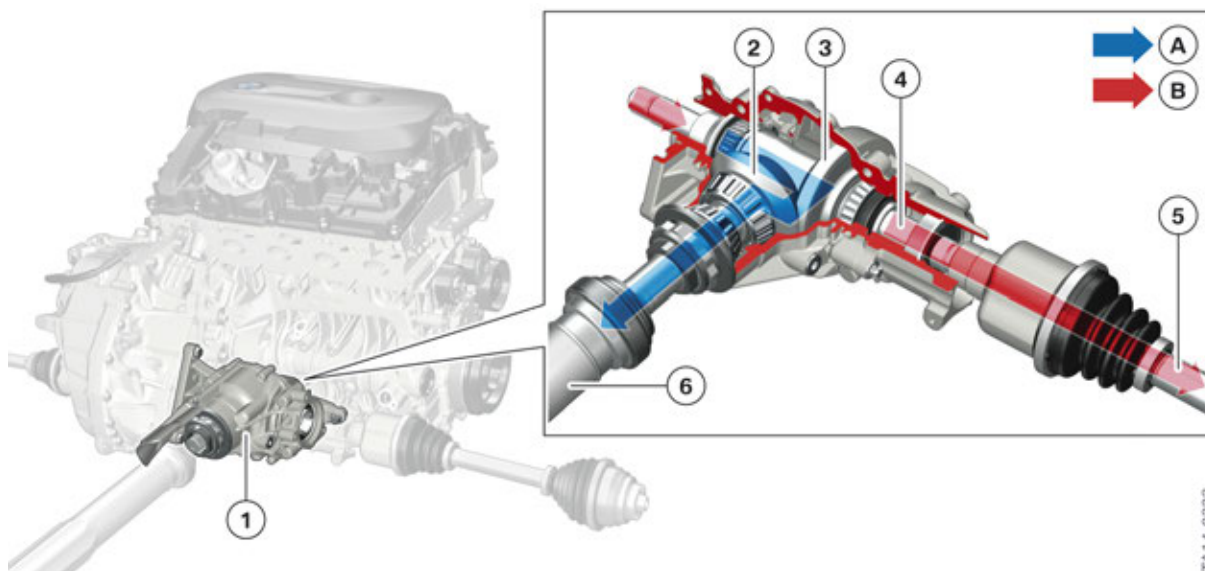
Index	Explanation
6	Rear wheel
7	Output shaft, rear
8	Cross member
9	Rear axle differential (with integrated longitudinal torque distribution)

With xDrive some of this driving power is transmitted to the rear output shafts (7) via the angular gearbox (3), the propeller shaft (5) and the rear axle differential (9). The gear ratio in the angular gearbox is 1.74 : 1 and in the rear axle differential 1 : 1.74.

The engine speed is increased and, at the same time, the torque is reduced, as a result of the ratio in the angular gearbox. The propeller shaft can therefore be designed with smaller dimensions. The weight reduction helps the fuel consumption and the fewer moving masses benefit the smooth running.

In the rear axle differential the ratio is then reversed, so that the same engine speed is applied to the front and rear output shafts.

4.2.1. Angular gearbox



F48 Angular gearbox

Index	Explanation
A	Driving power to the rear wheels
B	Driving power to the front wheels
1	Angular gearbox
2	Pinion shaft

F48 Powertrain

4. xDrive

Index	Explanation
3	Input shaft (hollow shaft) with crown wheel
4	Intermediate shaft
5	Output shaft, front right
6	Propeller shaft

The angular gearbox is located behind the engine and is secured at the automatic transmission and at the crankcase. It transmits some of the driving power to the propeller shaft and is designed as a single-stage, i.e. only has one fixed ratio.

The input shaft of the angular gearbox is designed as a hollow shaft and is connected directly to the differential housing of the front axle differential. The driving power is transmitted from the differential housing to the propeller shaft via the hollow shaft, the crown wheel and the pinion shaft.

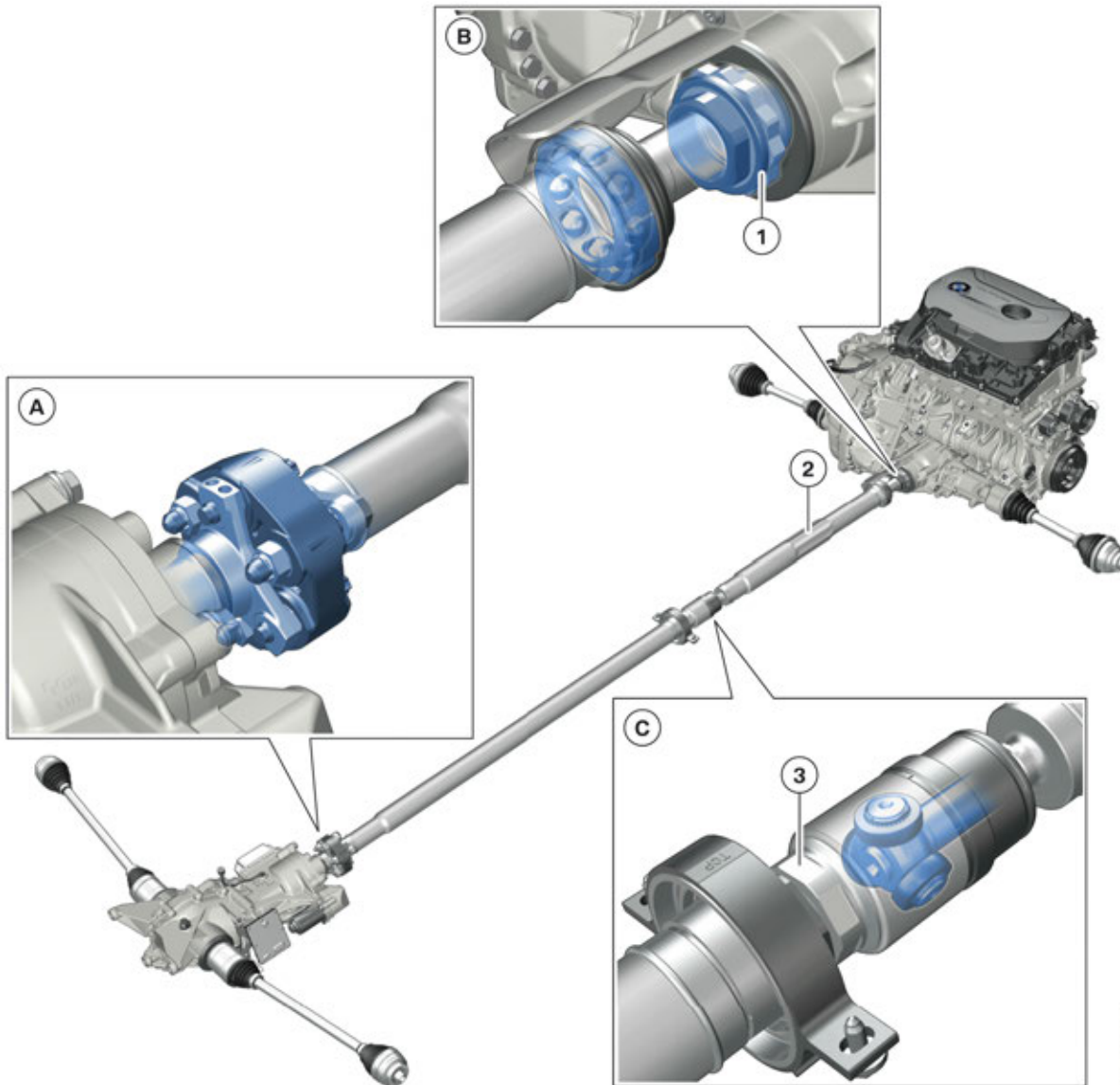
As a power interruption in the angular gearbox is not possible, the propeller shaft is driven continuously via the pinion shaft during the journey.

Irrespective of this, the intermediate shaft is guided to the front right output shaft through the hollow shaft and the crown wheel in the angular gearbox.

F48 Powertrain

4. xDrive

4.2.2. Propeller shaft



TA14-0324

F48 propeller shaft

Index	Explanation
A	Connection to rear axle differential via flexible disc
B	Connection to angular gearbox via a fixed ball joint with flange and inlay nut
C	Propeller shaft center bearing with tripod joint
1	Inlay nut
2	Shift unit
3	Hexagon head (for slackening the inlay nut at the angular gearbox)

F48 Powertrain

4. xDrive

The propeller shaft is responsible for transmitting driving power provided by the angular gearbox in the form of torque and engine speed to the rear axle differential. With help of the tripod joint, it offsets the deflection angle and linear variations resulting from the assembly movements.

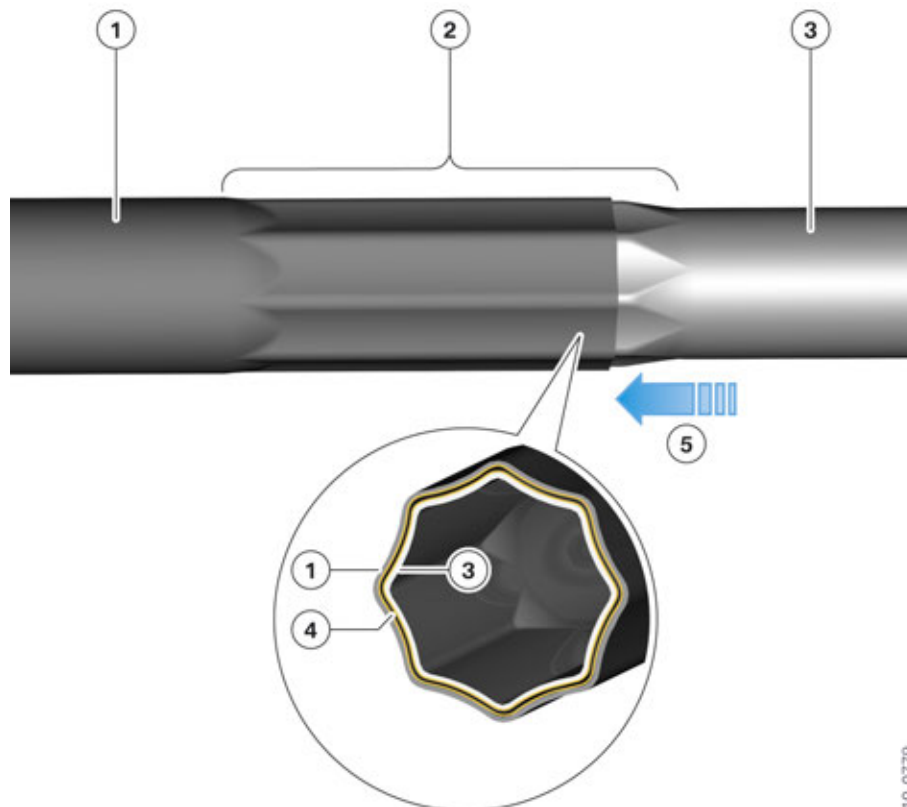
In front of the propeller shaft center bearing is a hexagon head (3), at which the propeller shaft can be rotated. As a result, for left-hand drive vehicles there is the option to remove the propeller shaft from the angular gearbox, if the inlay nut (1) is held over the right wheel arch at the same time.

In the F48 with four-wheel drive, the currently longest propeller shaft of all current BMW models is installed. It is 2.2 m long. It is designed as a two-piece tubular shaft and is secured to the body in the area of the middle joint via the flexible center mount.



The propeller shaft can be bent a maximum of 10°. Otherwise, the gaiter in the tripod joint will incur damage!

Support the propeller shaft during removal and installation and secure the gaiter with anti-kink protection. It is imperative the current repair instructions are observed when working at the propeller shaft.



F48 Shift unit of the propeller shaft

TA10-0779

F48 Powertrain

4. xDrive

Index	Explanation
1	Outer pipe (in direction of travel, rear)
2	Shift unit
3	Inner pipe (in direction of travel, front)
4	Coating (to achieve a defined low static friction force)
5	Shift direction

In the front propeller shaft sections, two contoured pipe sections are inserted in one another. The contour of the two pipe sections means it is possible to transfer the drive torque. In addition, the two pipe sections can be adjusted towards each other, whereby a coating generates a defined friction force of 20 kN.

In the event of a front-end collision, a counterforce of maximum 20 kN is generated, so that an additional load path is not created.

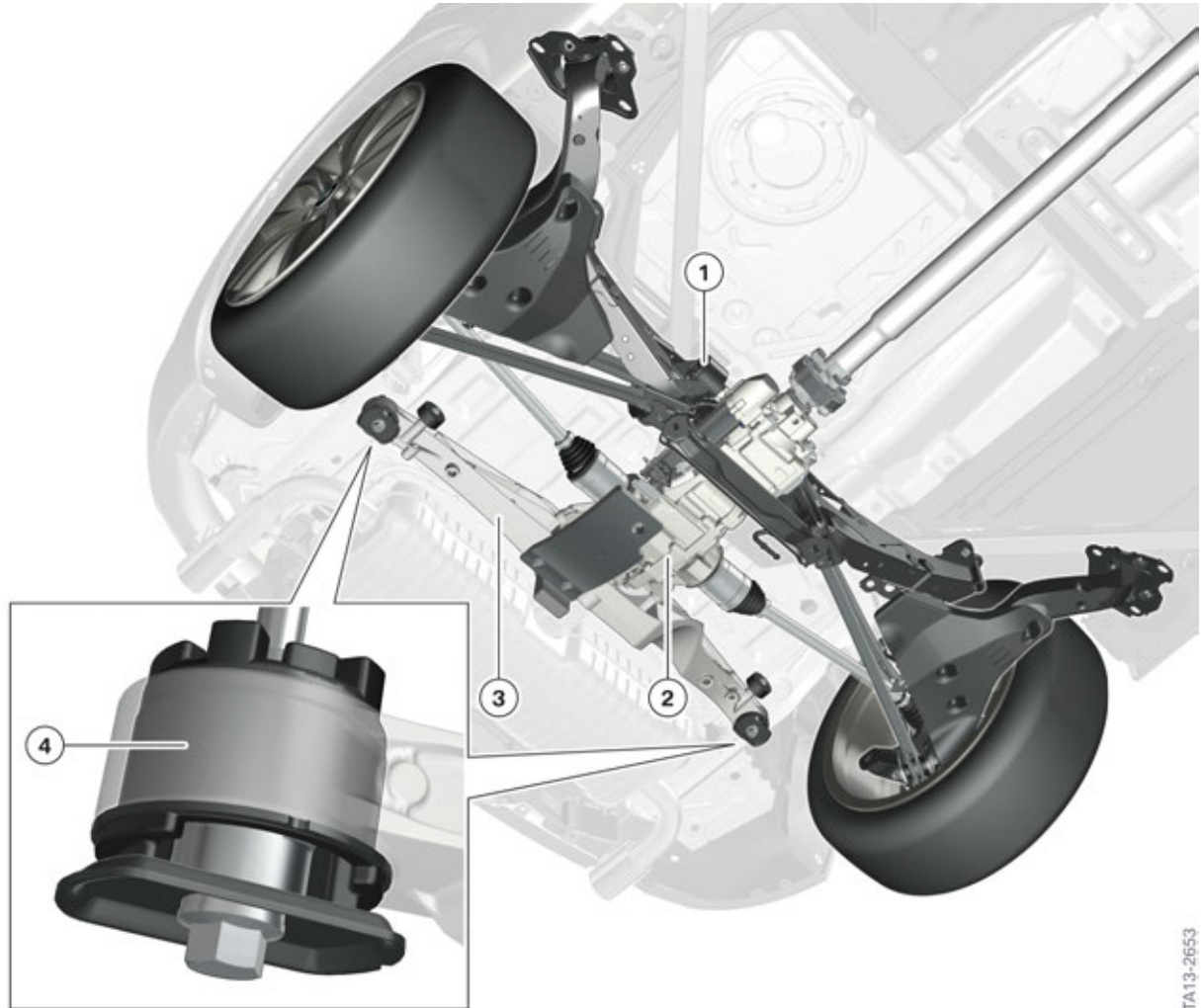


Following an accident, the shift unit of the propeller shaft must be checked. If the two pipe sections have shifted into one another, the propeller shaft must be replaced. The criteria for checking and replacing specified in the repair instructions are to be complied with precisely.

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4. xDrive

4.2.3. Rear axle differential



TA13-2653

F48 Rear axle differential

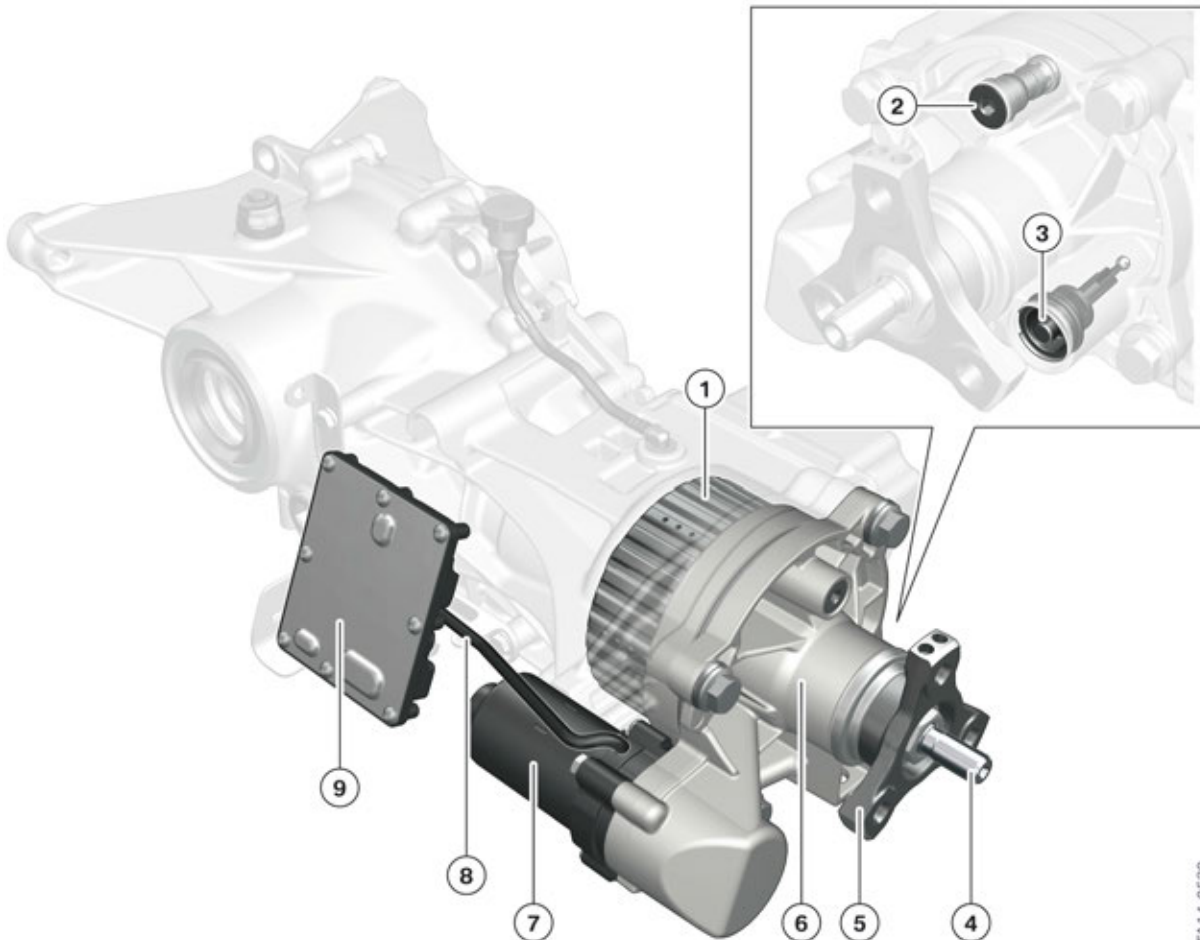
Index	Explanation
1	Bearing (rear axle differential to rear axle support)
2	Rear axle differential
3	Cross member
4	Bearing (cross member to body)

The rear axle differential in the F48 with four-wheel drive is secured at the front to the rear axle support and at the rear to an additional cross member. In order to decouple noises and vibrations of the drive train from the vehicle body, both the rear axle differential at the rear axle support, and the additional cross member at the body, are secured via rubber mountings.

F48 Powertrain

4. xDrive

Longitudinal torque distribution



TA14-0530

F48 Longitudinal torque distribution

Index	Explanation
1	Multidisc clutch
2	Vent valve
3	"Efficient valve"
4	Input shaft
5	Input flange
6	Clutch housing
7	EHPS
8	Electrical line
9	Longitudinal torque distribution (LMV) control unit

The longitudinal torque distribution in the F48 distributes the drive torque variably to the front axle and rear axle. It comes from the industrial modular system of the 5th generation of the Haldex system from BorgWarner.

F48 Powertrain

4. xDrive

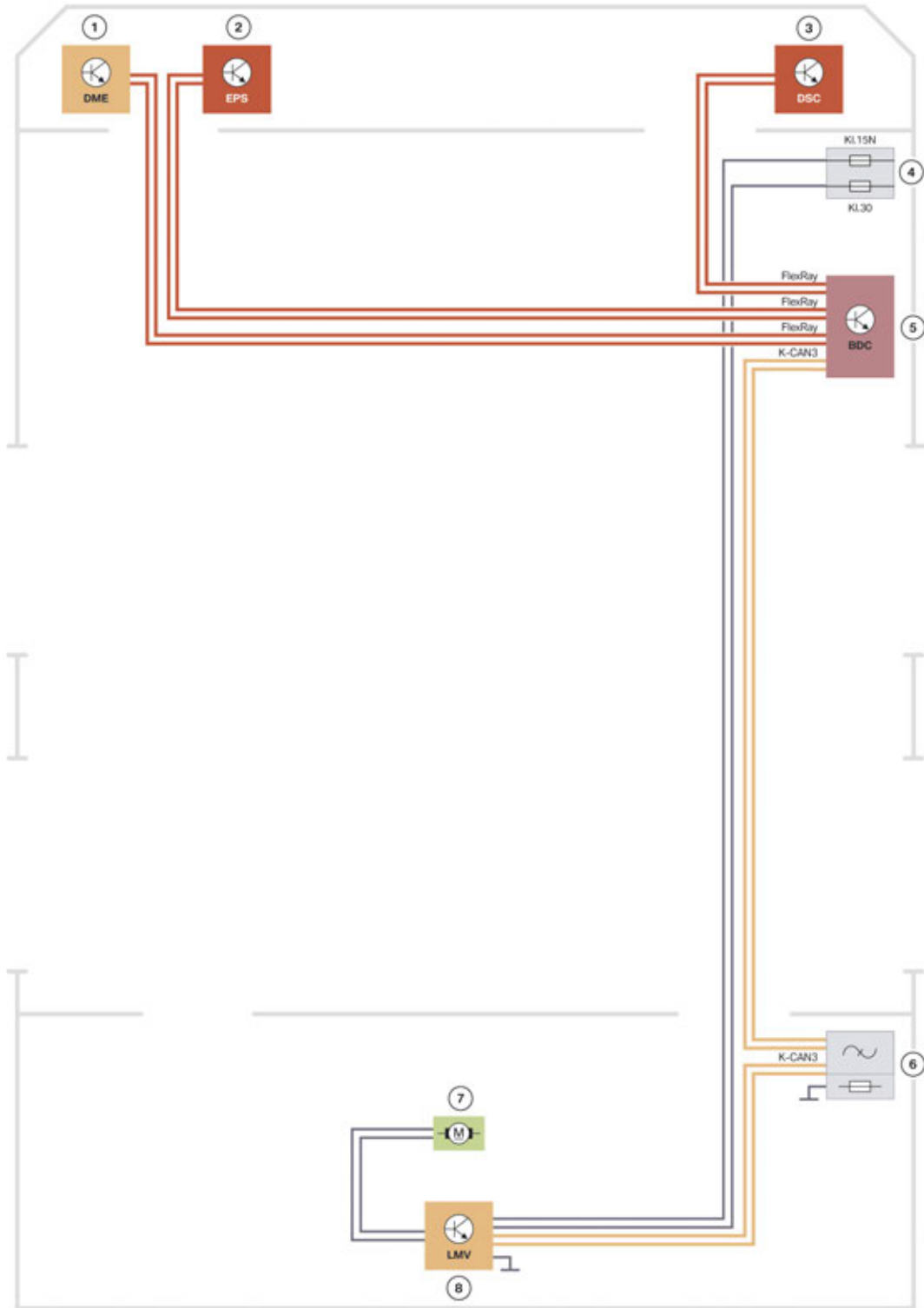
Both the longitudinal torque distribution control unit and the EHPS pump unit are secured at the side at the transmission.

The longitudinal torque distribution clutch is integrated in the rear axle differential. The input shaft is driven by the propeller shaft via the input flange. The output flange drives the differential, depending on requirements.

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4. xDrive

4.2.4. System wiring diagram



TE13-2702

F48 system wiring diagram for longitudinal torque distribution

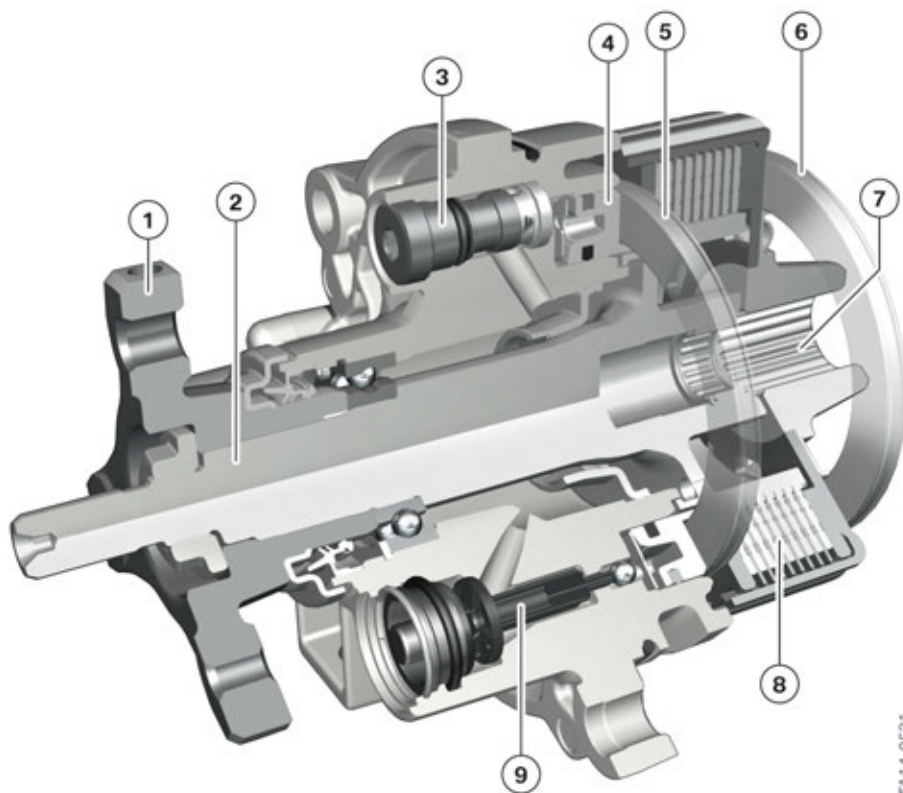
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4. xDrive

Index	Explanation
1	Digital Motor Electronics (DME)
2	Electronic Power Steering (EPS)
3	Dynamic Stability Control (DSC)
4	Power distribution box, passenger compartment
5	Body Domain Controller (BDC)
6	K-CAN terminator
7	Actuator, longitudinal torque distribution
8	Longitudinal torque distribution control unit (LMV)

4.3. Function

4.3.1. Longitudinal torque distribution



F48 clutch, longitudinal torque distribution

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4. xDrive

Index	Explanation
1	Input flange
2	Input shaft
3	Vent valve
4	Working piston
5	Axial needle bearing
6	Axial needle bearing
7	Output flange
8	Multidisc clutch
9	"Efficient valve"

Depending on the driving situation, the longitudinal torque distribution can direct some of the driving power (up to maximum torque of 1300 Nm) to the rear axle, sometimes before the wheels even spin.

The DSC sends information about the clutch torque to be adjusted to the BDC via FlexRay and to the longitudinal torque distribution control unit via the K-CAN3. The longitudinal torque distribution control unit controls the speed of the EHPS using pulse-width modulations. Depending on the speed, the EHPS applies an operating pressure of 0 to 40 bar to the clutch longitudinal torque distribution.

The pressure is not measured by a pressure sensor, but checked via a voltage/current comparison.

In driving situations in which the four-wheel drive is not required, the system switches to "Efficient mode". The "Efficient valve" lowers the oil level in the clutch, thus reducing the splashing losses. If the four-wheel drive is required again, the maximum torque can be provided within 250 ms. The spring-loaded "Efficient valve" is operated by the oil pressure.

Adaptations, which monitor the system behavior and ensure position precision, are constantly performed in the longitudinal torque distribution control unit. A calibration is performed once during the driving cycle (terminal 15 ON) and stored.

Together with the calibration, a system ventilation is also carried out. The pressure is increased briefly to approximately 45 bar in order to open the vent valve. The ventilation procedure guarantees quick pressure build-up in every regulating situation.

F48 Powertrain

4. xDrive

4.3.2. Operating strategy

The operating strategy ensures that the four-wheel drive is operated as required and in an energy efficient manner. The traction requirement is detected in a proactive manner and the drive torque redirected accordingly.

In most driving situations only the front wheels are driven. Only in certain situations is some of the drive torque also transmitted to the rear wheels. The distribution of the drive torque between the front and rear wheels is defined by the DSC. The following criteria are taken into account:

- Speed
- Lateral and longitudinal acceleration
- Brake control
- Steering angle
- Wheel speeds
- Vehicle longitudinal inclination
- Pedal sensor position
- Active driving program (SPORT, COMFORT, ECO PRO)
- DSC status (DSC activated/deactivated, DTC activated/deactivated)

Depending on the driving situation, some of the drive torque is transmitted to the rear wheels. The exact ratio of the torque distribution is dependent on the activation of the multidisc clutch, as well as the slip of the wheels. Some factors on the activation of the multidisc clutch are listed below.

The four-wheel drive is activated in the following situations, if there are no other criteria present which prevent this:

- Understeering vehicle
- Increased difference in speed between front and rear wheels
- Large vehicle longitudinal inclination (e.g. on inclines)
- Kick-down position
- Sporty driving style
- Respective environmental conditions, roadway conditions and type of terrain

The four-wheel drive is switched off in the following situations, if there are no other criteria present which prevent this:

- Large steering angle and driving speeds
- Strong braking (ABS)

To assess the road condition and thus for effective, proactive longitudinal torque distribution, the coefficients of friction between the tires and roadway are calculated by the DSC. The wheel slip, as well as the longitudinal and lateral acceleration, are evaluated.

F48 Powertrain

4. xDrive

If wheel speed information received by the DSC suggests different tire rolling circumferences of the wheels (e.g. for tires with varying degrees of wear), the multidisc clutch is no longer closed 100 %. Differences in speed, resulting from different wheel speeds at the front and rear axle, are reduced in this case via the multidisc clutch, so that high torques are not transmitted to the drive train.

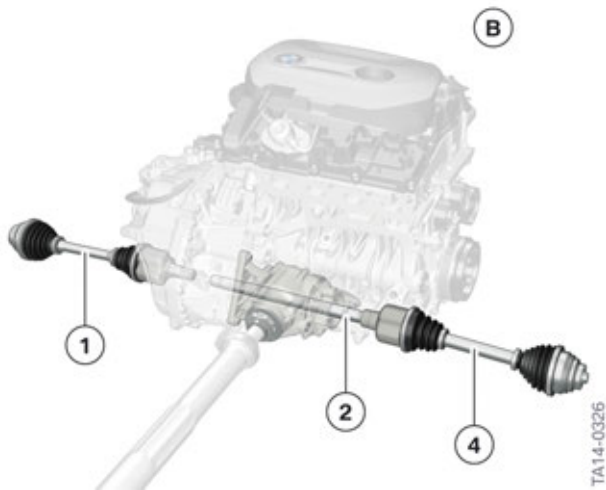
As the multidisc clutch is not closed 100 % in this situation, the maximum transmittable drive torque to the rear axle is reduced.

4.4. Notes for Service

- The propeller shaft must be removed when working on the brake test stand.
- When working on the brake test stand, all-wheel drive vehicle-specific points do not have to be observed (the test stand mode for checking the brake system is automatically detected).
- The vehicle cannot be towed away if only one axle is raised.
- Both the angular gearbox and the rear axle differential have an oil filling that lasts the entire service life of the assembly.
- Using the diagnosis system, both the mechanics and the tightness of the EHPS can be checked (here the pressure is checked via a voltage/current comparison).
- In order to remove the angular gearbox, the starter motor also has to be removed.
- Similar to the previous all-wheel drive system, tires with very different tread depths cannot be used at the front and rear axle.
- The maximum permissible deflection angle of the propeller shaft cannot be exceeded.

F48 Powertrain

5. Output Shaft, Front



F48 Output shafts, front

Index	Explanation
B	F48 with four-wheel drive
1	Output shaft, front left
2	Intermediate shaft
3	Output shaft, front right

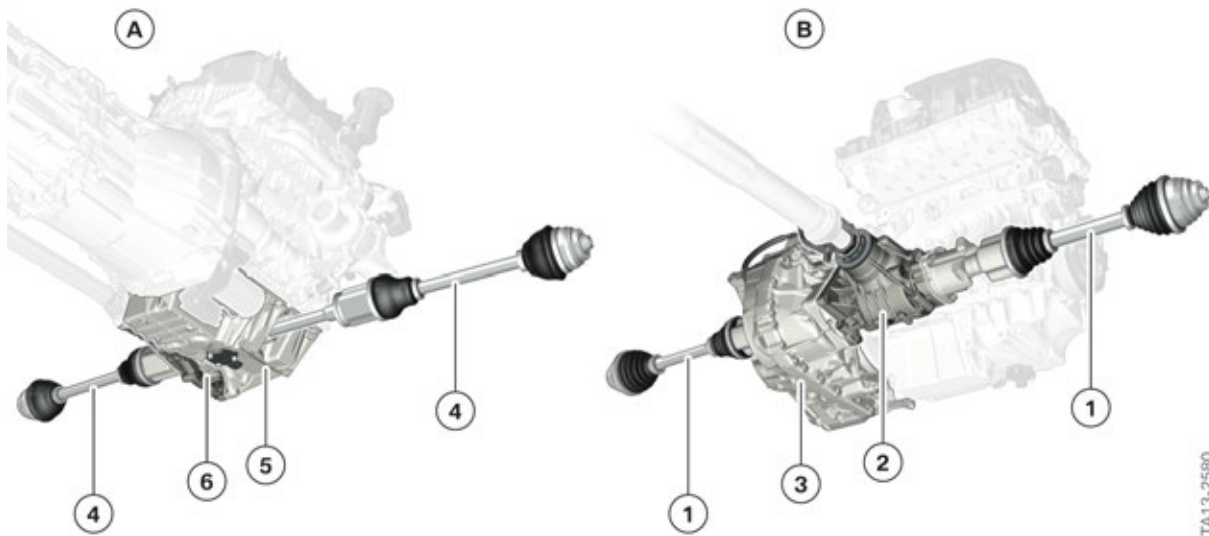
The left output shaft is designed as a single piece. The right output shaft consists of an intermediate shaft at the engine and the actual right output shaft. Both output shafts are roughly the same length and have similar torsional rigidity.

The front output shafts are designed according to the maximum transmittable torque, in order to achieve minimal component weight.

The transmission-end tripod joints offset differences in length and deflection angles, the wheel-side fixed ball joints only offsets the deflection angles. The interfaces for the transmission or the intermediate shaft are defined as a journal solution and are designed depending on the respective transmission. The interface for the wheels is designed as a spur gearing solution and is identical for all sizes.

F48 Powertrain

5. Output Shaft, Front



TA13-2580

Comparison of front output shafts for vehicles with four-wheel drive: F25 – F48

Index	Explanation
A	F25
B	F48
1	Output shaft, front
2	Angular gearbox
3	Transmission
4	Output shaft, front
5	Oil sump
6	Front axle differential

Due to the transversal installation of the engine and transmission, in the F48 the front output shafts no longer have to be guided by the oil sump, as for example in the BMW X3 xDrive. In vehicles with a four-wheel drive, however, the front right output shaft is guided by the angular gearbox.



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